Using the NASA polar orbiting fire product record to enhance and expand the Global Wildfire Information System (GWIS)

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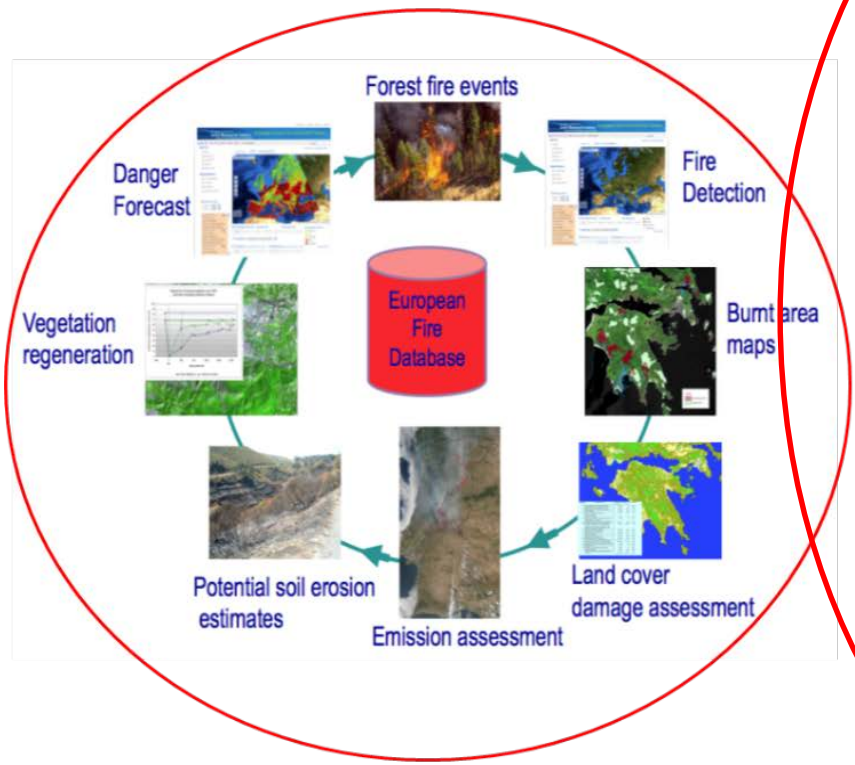
Overarching Goal of the Project

Expanding GWIS by incorporating the NASA fire products, enabling a comprehensive view and evaluation of fire regimes and fire effects in support of policy making and national resource management.

Overarching Goal of the Project

GWIS



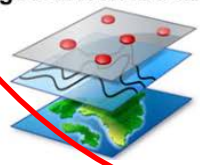
Current Situation

Services

Fire History

Fire News

Downloadable georeferenced data



Proposed activities

NASA fire products:

- MODIS C6 MOD14 active fire product
- MODIS C6 MCD64 burned area product
- Pathfind the transition to VIIRS

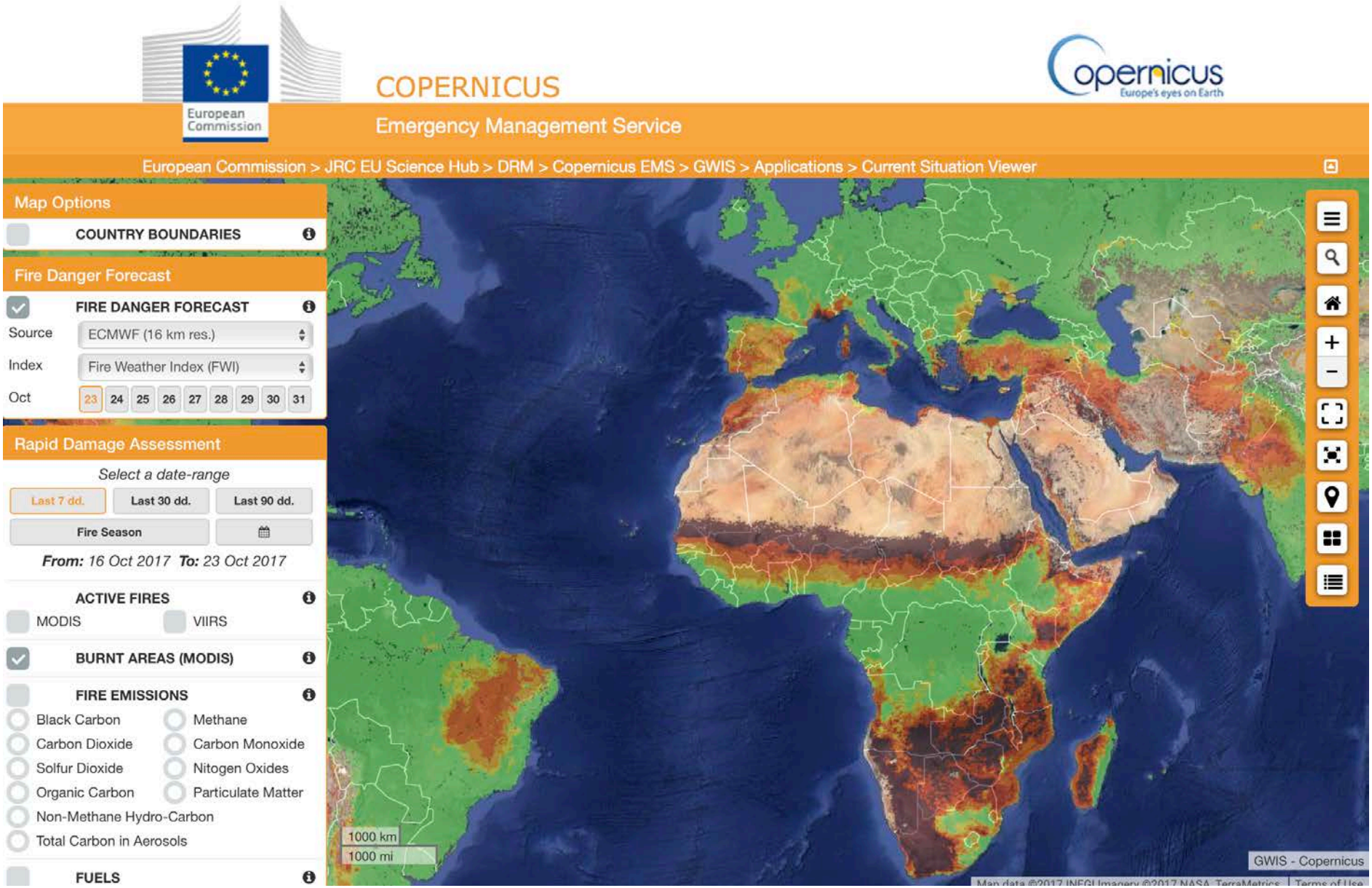
Proposed activities

To deliver datasets and tools to be incorporated in GWIS for:

- visualization of Burned Area Products
- on-demand statistics
- tabular and graphical information

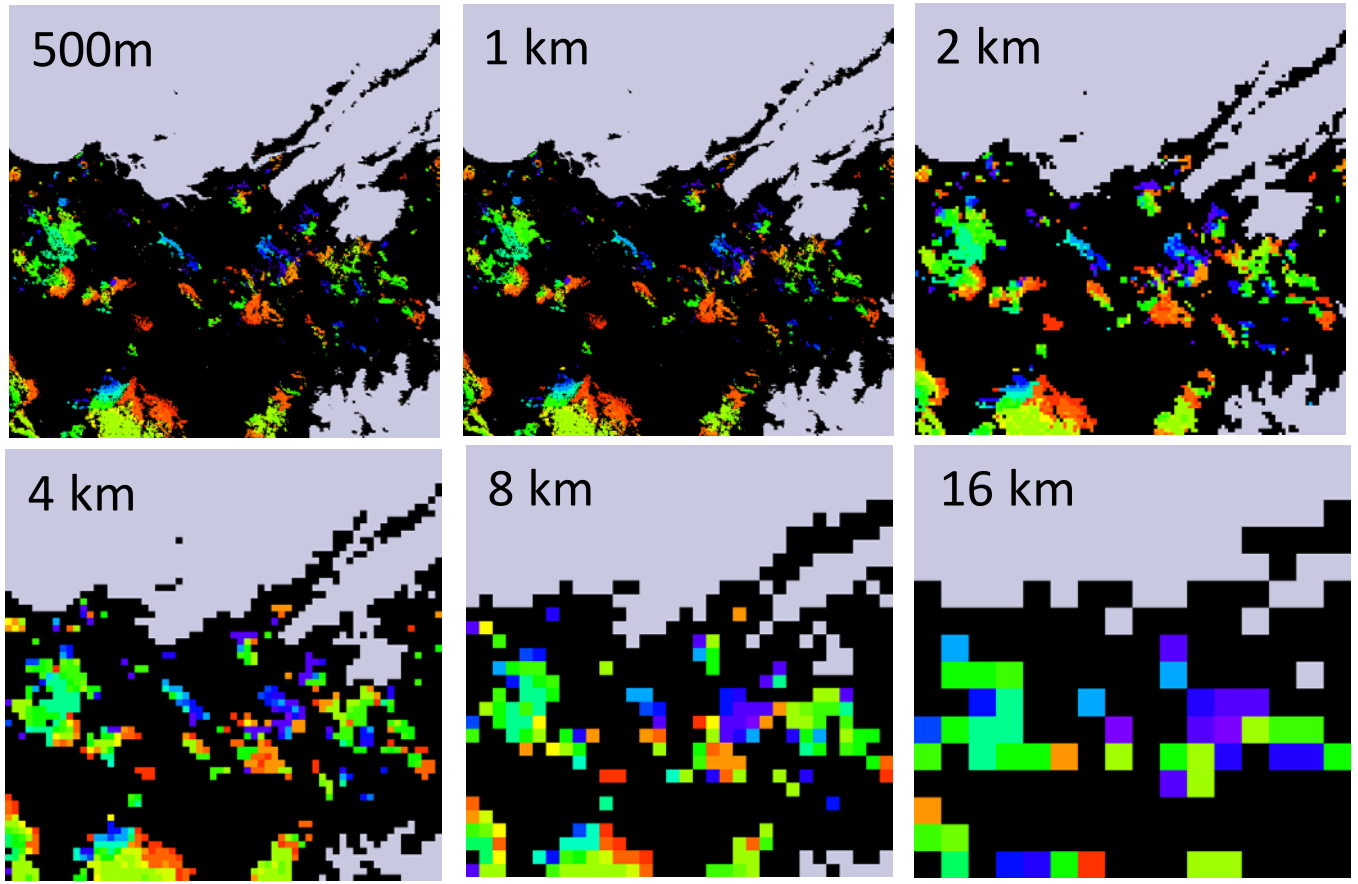
State/regional, national, sub-continental, continental, and global scales

Monthly, seasonal and annual time periods


European Commission
COPERNICUS
Emergency Management Service
Copernicus
Europe's eyes on Earth
European Commission > JRC EU Science Hub > DRM > Copernicus EMS > GWIS > Applications > Current Situation Viewer
Map Options
COUNTRY BOUNDARIES
Fire Danger Forecast
FIRE DANGER FORECAST
Source
ECMWF (16 km res.)
Index
Fire Weather Index (FWI)
Oct
23 24 25 26 27 28 29 30 31
Rapid Damage Assessment
Select a date-range
Last 7 dd.
Last 30 dd.
Last 90 dd.
Fire Season
From: 16 Oct 2017 To: 23 Oct 2017
ACTIVE FIRES
MODIS
VIIRS
BURNT AREAS (MODIS)
FIRE EMISSIONS
Black Carbon
Methane
Carbon Dioxide
Carbon Monoxide
Solfur Dioxide
Nitogen Oxides
Organic Carbon
Particulate Matter
Non-Methane Hydro-Carbon
Total Carbon in Aerosols
FUELS
1000 km
1000 mi
GWIS - Copernicus

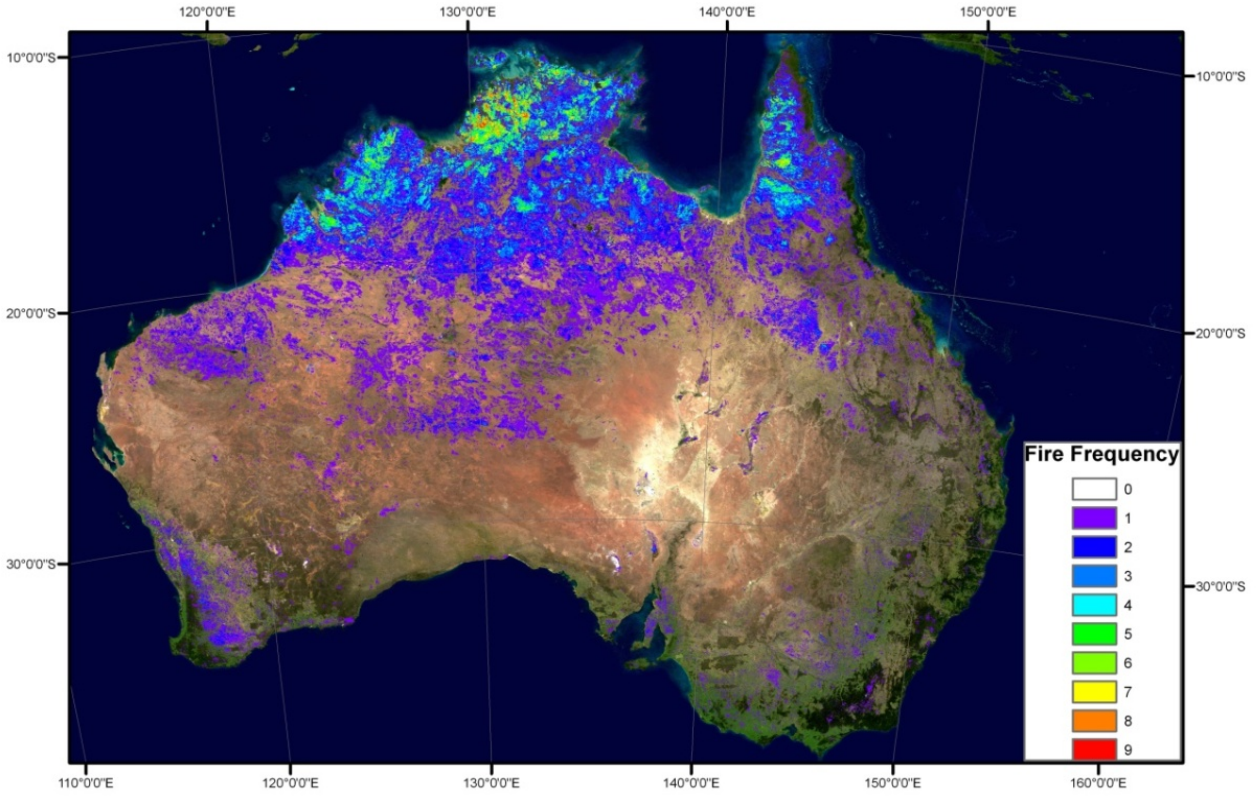
Burned Area Visualization

Develop and incorporate software for rigorous multi-scale visualization



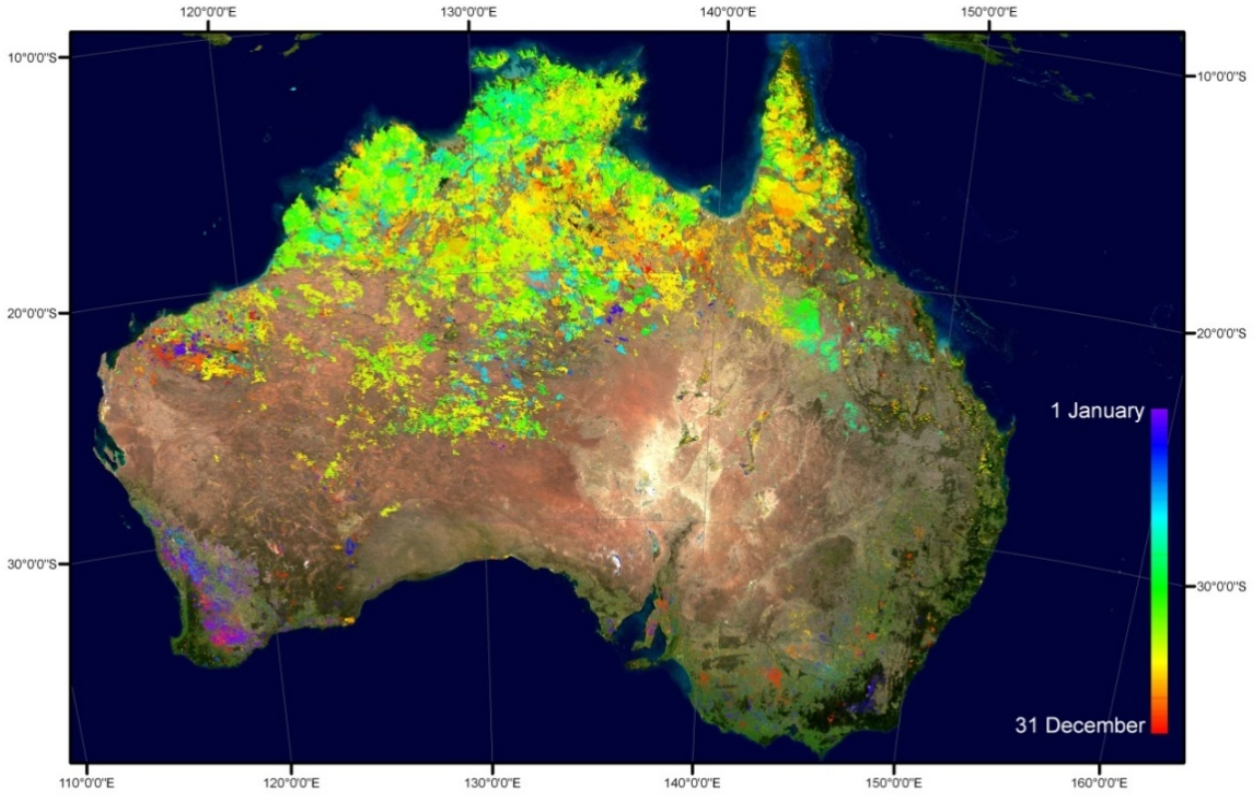
Burned Area Visualization

Layers with summary information on historical fire activity



Burned Area Visualization

Layers with summary information on historical fire activity



Summary Fire Metrics

Summary fire information for non-science users, in support of national fire assessment and national fire operations.
Designed for easy access by analysts (EFFIS model):

- overview of current season
- overview of historical fire regimes
- omparison between current season and historical data (detection of anomalies)

Preliminary list of metrics

Total area burnt and number of active fire detections (computed monthly and yearly)

- total area burned (ha and km^2) with uncertainty estimates
- total number of active fire detections (counts)
- temporal ranking of the above and the year/month that the ranked values occurred on
- counts of the number of months or years where there was no fire (burned area = 0 km^2, or number of active fires detected = 0)

Preliminary list of metrics

Fire seasonality metrics (computed yearly):

- start of the fire season and end of the fire season, peak month of burning
- temporal ranking of the above and the year/month that the ranked values occurred on

Preliminary list of metrics

Fire size metrics (computed yearly):

- mean, median and maximum fire size
- number and minimum size of the fires responsible for 25%, 50%, 75% of the total annual burned area

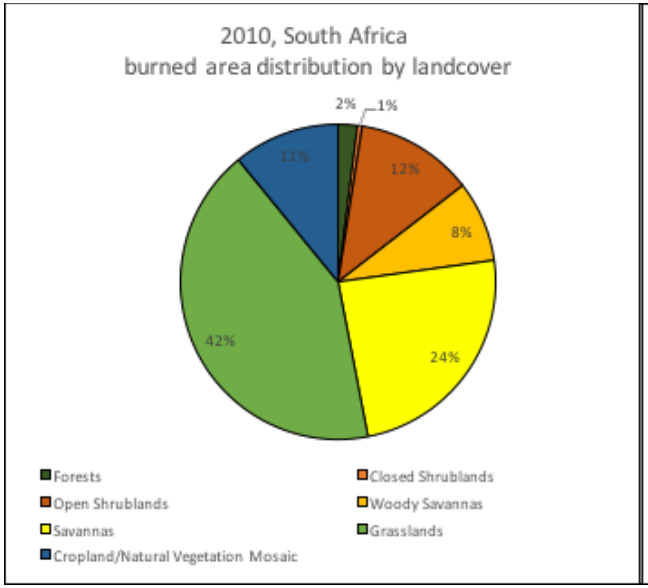
Spatial Reporting Units

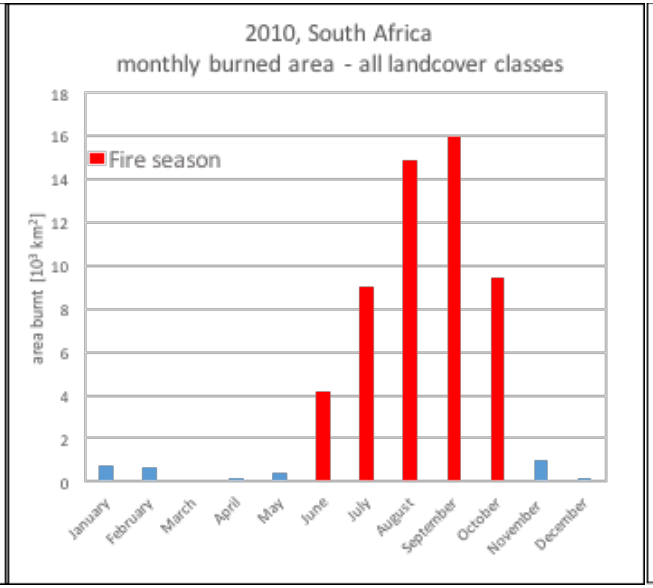
Metrics computed at these scales:

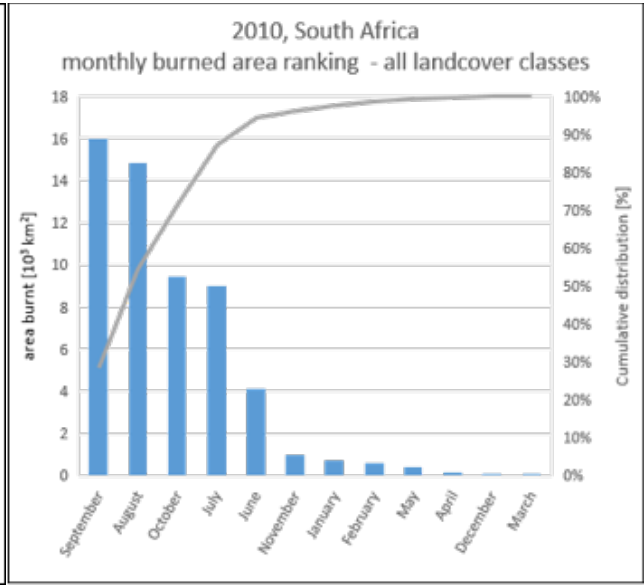
- sub-national, (GAUL Level 1 boundaries)
- national, (GAUL Level 0)
- sub-continental
- continental
- global

On-demand plots and charts

“Country dashboard” with easy access to fire information at the national and subnational level. Directly supports national fire assessment.







GOFC partnership

- Annual presentation at GWIS and GOFC meetings
- Involvement and consultation of the regional networks in developing documentation and support material
- Feedback on
  - Visualizations
  - Fire metrics

Data Quality Issues

Providing information for policy support requires

- Documented, transparent and reproducible methods
- Statistically rigorous protocols for the assessment of uncertainties
- Propagation of the uncertainties into the summary metrics

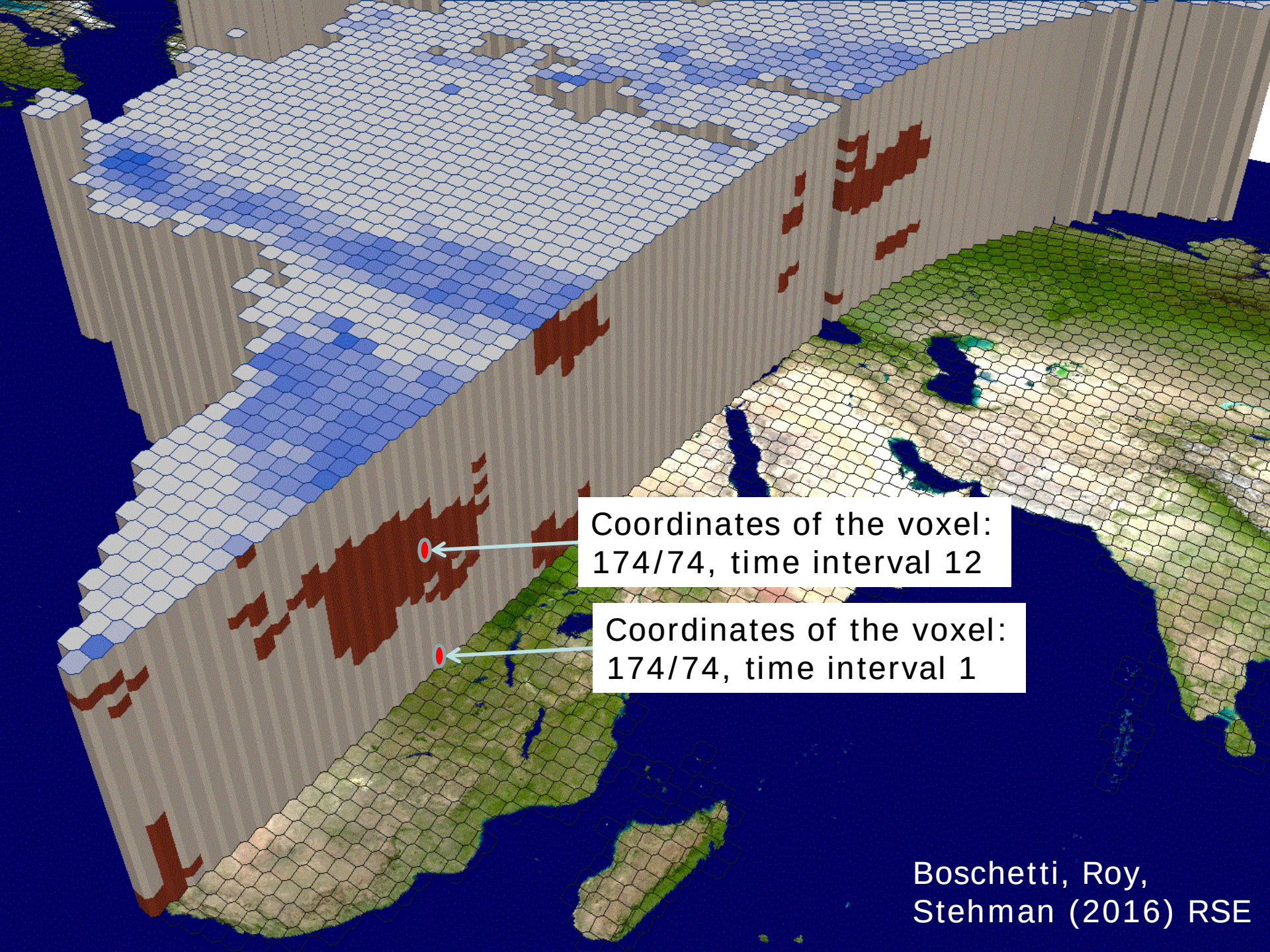
CEOS CAL VAL validation stages

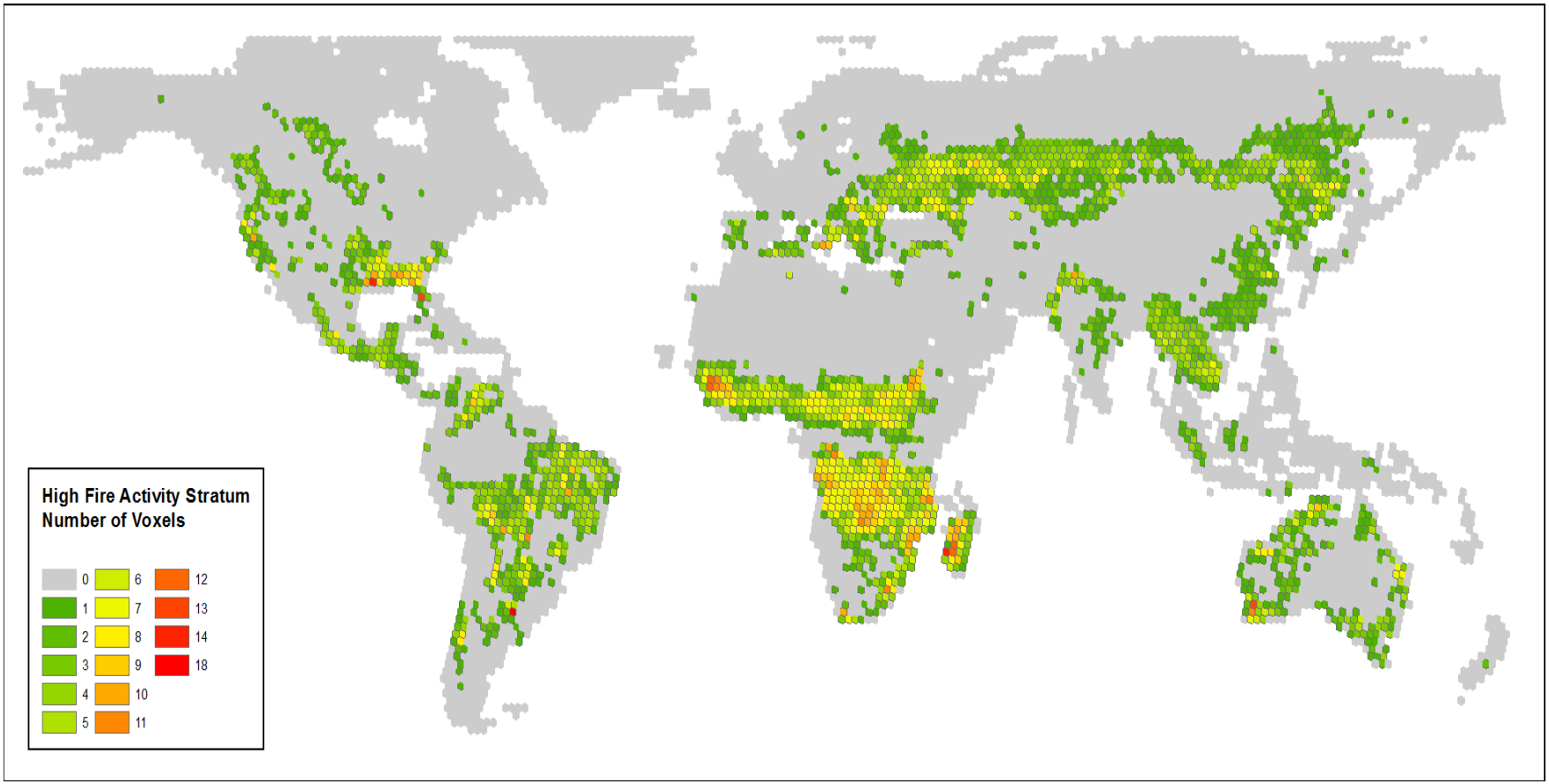
- Stage 1 Validation: Product accuracy has been estimated using a small number of measurements obtained from selected locations and time periods
- Stage 2 Validation: Product accuracy has been assessed over a widely distributed set of locations and time periods, representative of the full range of conditions present in the product.
- Stage 3 Validation: Product accuracy has been assessed, and the uncertainties in the product established via independent measurements made in a statistically robust way that represents global conditions, and is characterized by the selection of reference data via a probability sampling i.e., design-based validation.
- Stage 4 Validation: Validation results for Stage 3 are systematically updated when new product versions are released, or when the time coverage of existing products expands.

Stage 3:
Design based validation

- A limited number of elements (the *sample*) is extracted from all the possible validation data (the *population*) according to a probability distribution (*sampling probability*)

- Accuracy metrics derived from the samples may be combined using the sampling probability to estimate accuracy metrics that are representative of the population


Coordinates of the voxel:
174/74, time interval 12
Coordinates of the voxel:
174/74, time interval 1
Boschetti, Roy,
Stehman (2016) RSE

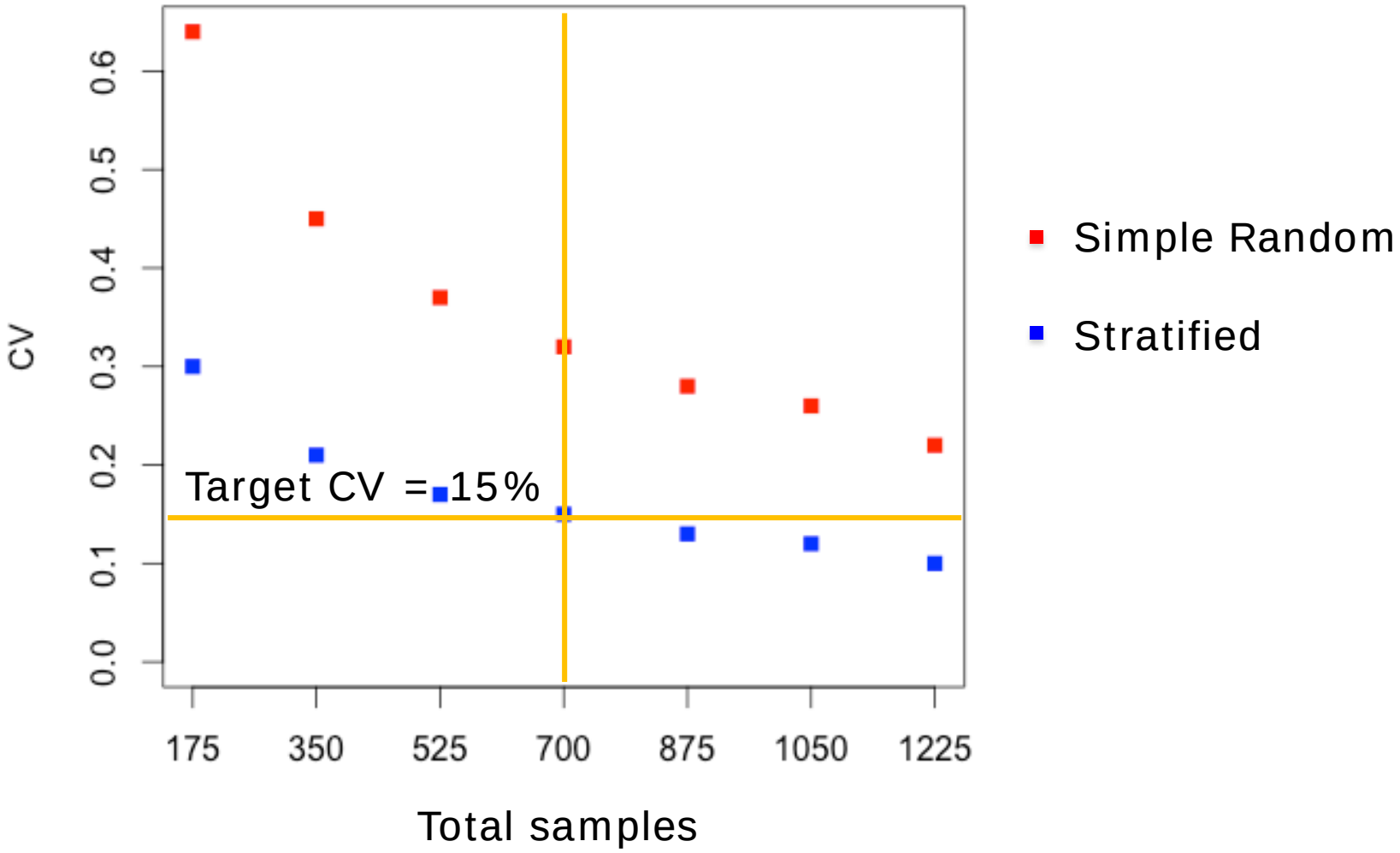


Number of ‘High Fire’ voxels at each WRS path/row location

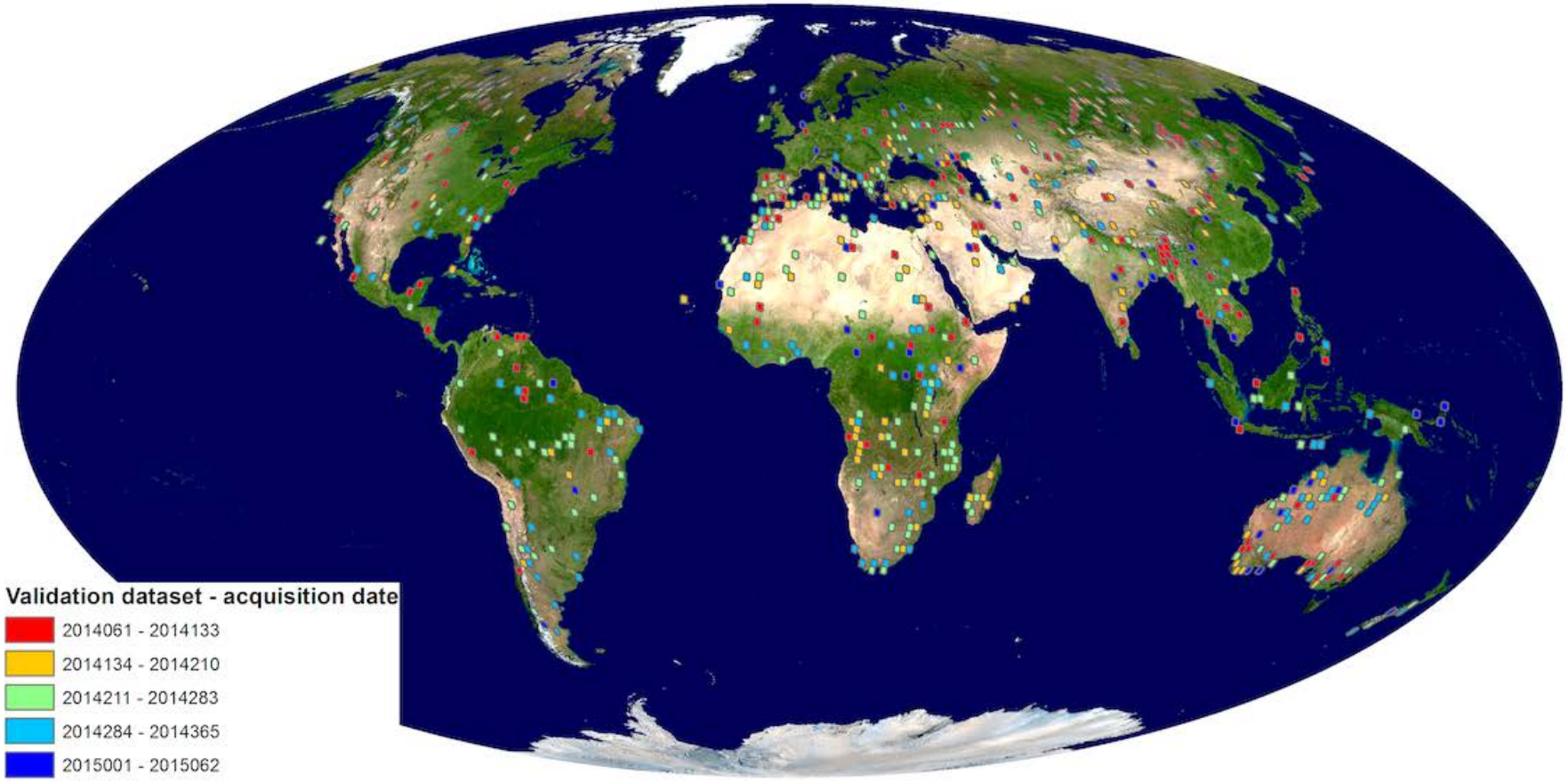
Is the stratification effective?

- The benefit of stratified random sampling is the reduction of standard errors relative to simple random sampling
- It can be analytically computed provided that a full validation dataset is available
- Simulation using synthetic datasets
  - MCD45 acting as the reference data
  - MOD14 acting as the map to be validated

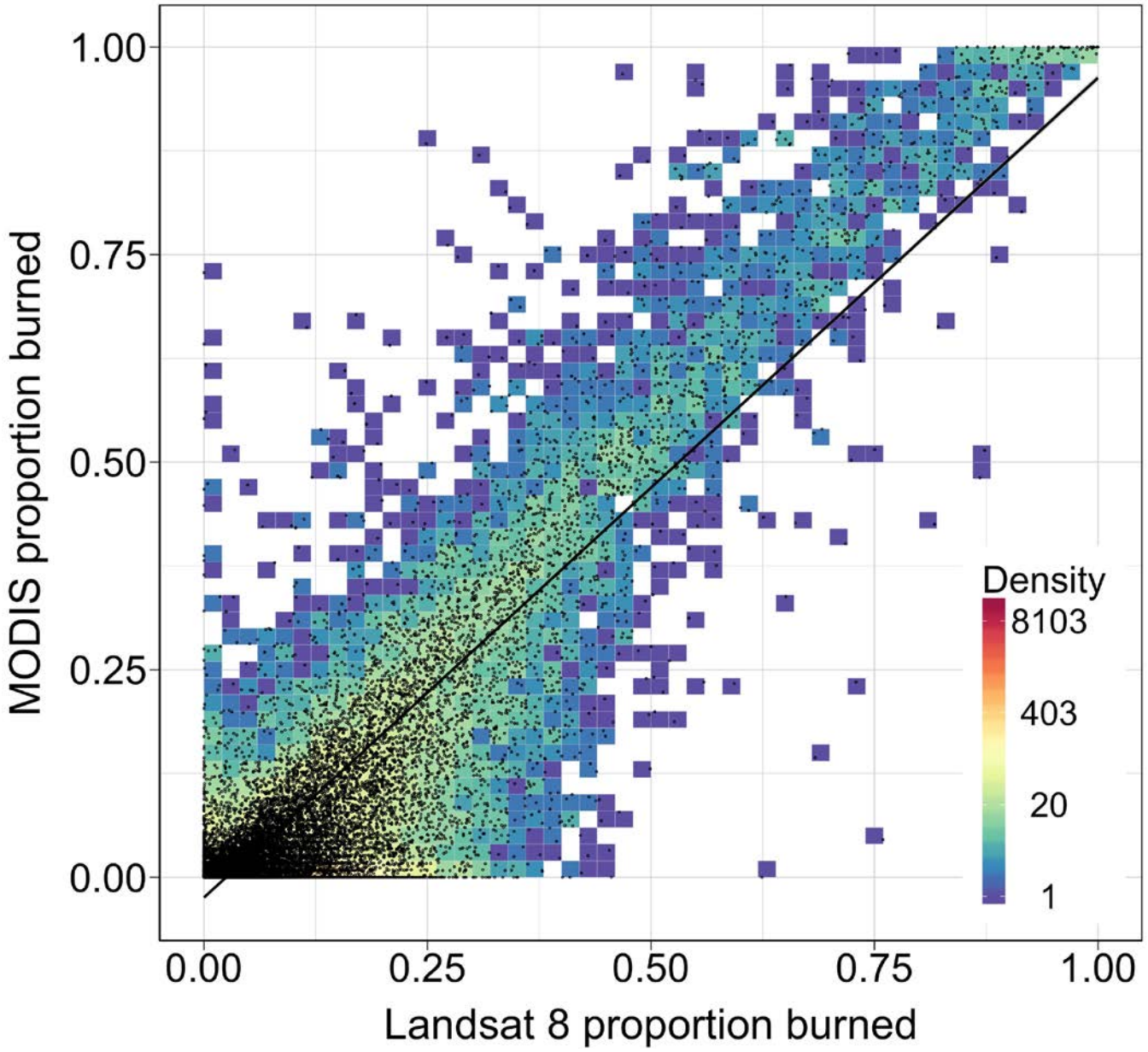
Coefficient of variation of the **global annual area burnt**
as a function of the total number of samples



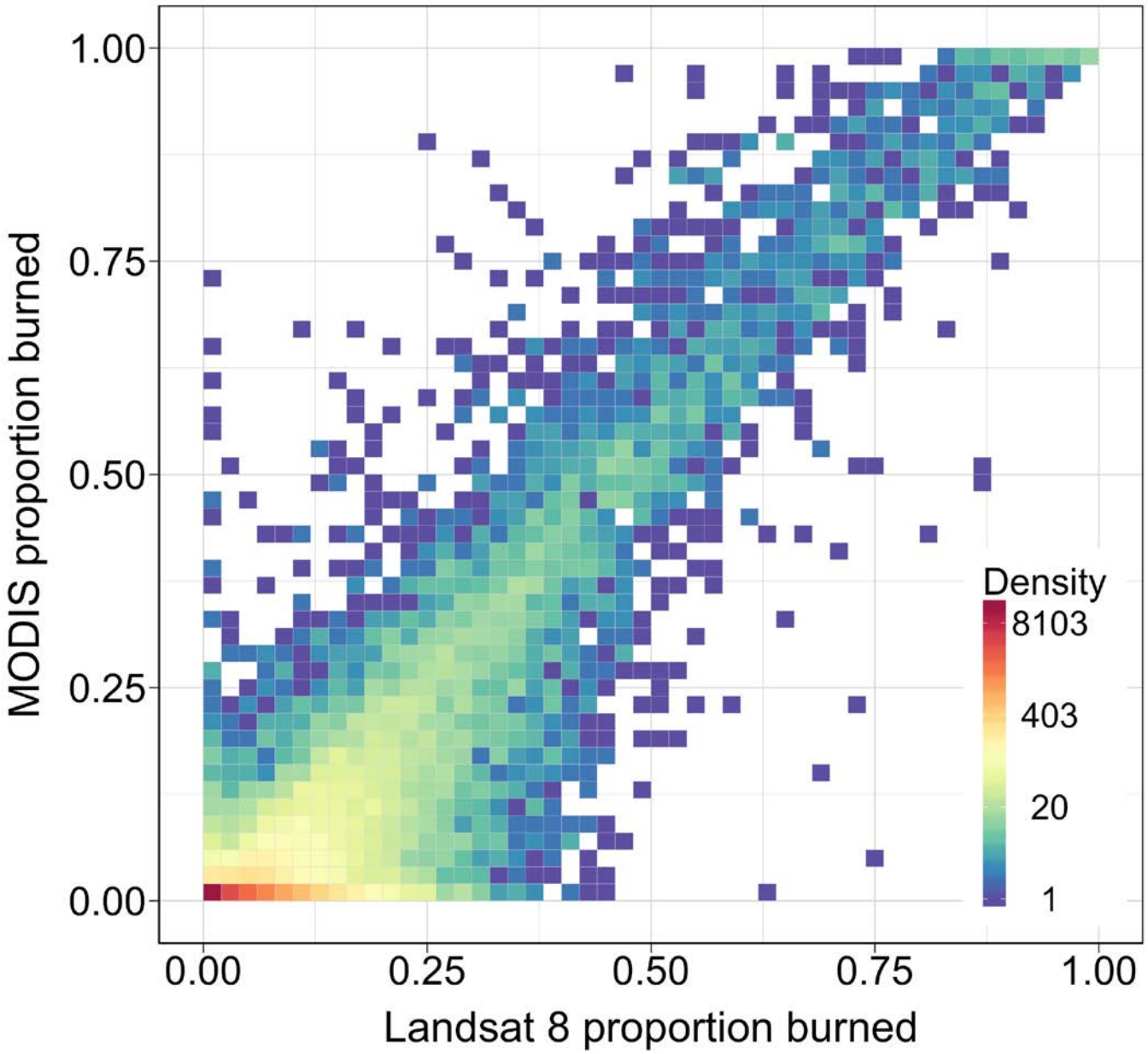
700 samples: 50 scenes per stratum (50 high fire and 50 low fire per biome)



700 Landsat-8 image pairs to validate one year of MCD64A1,
April 2014 - April 2015
temporal overlap with VIIRS



Tropical Savannah, high fire stratum
43 scenes, proportion of area burned in 5km x 5km cells
Slope: 0.99 Intercept: -0.02 r^2=0.81 n=33597 cells



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